

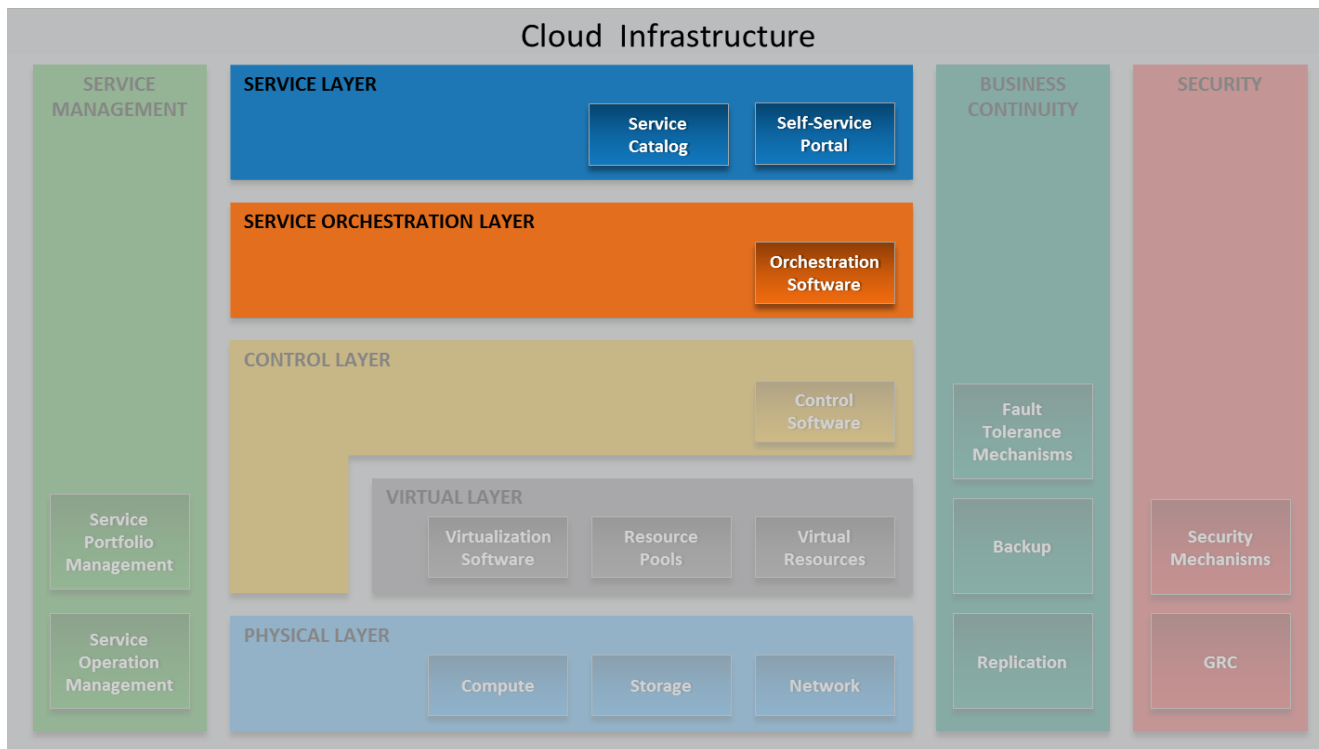
Module: Service and Orchestration Layers

Upon completion of this module, you should be able to:

- Discuss service layer functions
- Describe cloud portal
- Describe cloud interface standards
- Describe protocols for accessing cloud services
- Discuss service orchestration
- Describe cloud service lifecycle

Cloud Computing Reference Model

Service and Orchestration Layer



Lesson: Service Layer Overview

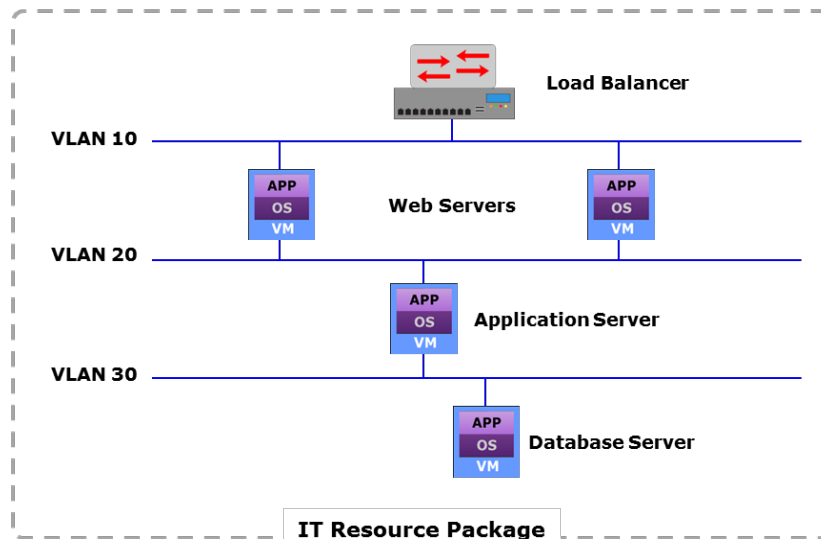
This lesson covers the following topics:

- Service layer functions
- Service catalog and its elements
- Service ordering
- Cloud interfaces

What is Cloud Service?

Cloud Service

IT resources that are packaged by the service providers and are offered to the consumers.



Example of Cloud Service

Service Layer Functions

- Enables defining services in a service catalog
 - Service catalog provides central source of information on service offerings
- Enables on-demand, self-provisioning of services
 - Consumers order or request services from a service catalog unilaterally
- Presents cloud interfaces to consume services
 - Cloud interfaces are functional and management interfaces

Service Catalog

Service Catalog

Menu of services that lists services, attributes of services, service level commitments, terms and conditions for service provisioning, and prices of services.

- Providers define services in catalog
- Consumers order services from the catalog in a self-service way

EMC² infinitt PRODUCTS & SERVICES SUPPORT

Infiniti > Product & Services > Cloud Services

Xpress Database

★★★★★
Rate Me...

Get Your Xpress Database Here!

EMC IT offers a reliable, monitored, and managed database product called Xpress Database. The database enables business units, engineers, and other EMC groups, a quick, cost effective, and self-managed application environment. Your database is offered on Oracle or Microsoft SQL Server and is flexible, scalable, and secure. Once set up, these databases are fully licensed. There is a one time set up charge of \$200 per instance.

From: £220.76 GBP
Commitment: Monthly
Estimated Delivery: 1 Business Day

[Order](#)

IT Support »

- [Self Help](#)
View articles for this item.
- [All other IT Support](#)
View all your support options.

Features **Models** Detailed Specs Intended Use SLA What You Get

Model:

	Oracle Xpress Database	SQL Xpress Database
Nickname:	Oracle	SQL Server
Database:	Oracle	SQL Server
CPU:	1 vCPU (Expandable to 4 vCPU)	1 vCPU (Expandable to 4 vCPU)
Memory:	4 GB (Expandable to 16 GB)	2 GB (Expandable to 8 GB)
Storage:	100 GB (Expandable to 300 GB)	100 GB (Expandable to 300 GB)
Pricing:	Depends on configuration selected. Starting at \$501.00.	Depends on configuration selected. Starting at \$364.
Price:	£303.86 GBP	£220.76 GBP

[Order](#) [Order](#)

Service Catalog of EMC's Private Cloud Database Service



Common Elements of Service Catalog

- Service category
 - Service name
 - Service description
 - Features and options
 - Service and support expectations
 - Price
 - Provisioning timeframe
 - Reference to service-related documents (for example, SLA, specification sheet)
1. What is a service?
 2. What business process it supports?
 3. What value it provides?
1. What are the constraints, policies, and rules?
 2. What options are available for selection?
 3. How billing is performed?
 4. Does early termination impact billing
1. What are the qualities of a cloud service?
 2. What are the available technical support services?

Service Ordering

Choose a Service from a Service Catalog



Click on Appropriate Link to Start Ordering



Fill Up Web Form



Agree to Contract Terms and Submit the Form

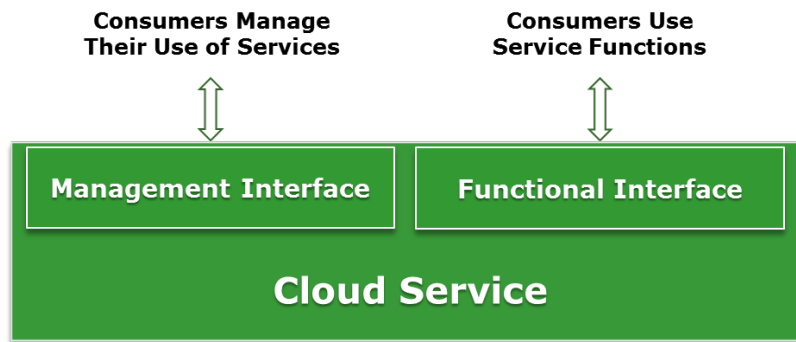
The screenshot shows the EMC2 infinIT web interface. At the top, there is a navigation bar with the EMC2 infinIT logo, 'PRODUCTS & SERVICES', and 'SUPPORT'. Below the navigation bar, there is a 'Welcome' section with a user profile icon and a 'Welcome' heading. To the right of the heading are four links: 'CART 0', 'REQUESTS & ORDERS 0', 'APPROVALS 0', and 'INCIDENTS 0'. The main content area is divided into several sections:

- Select Database Configuration:** A dropdown menu showing 'Oracle Xpress Database - Large'.
- Storage:** A dropdown menu showing '100 GB Storage (included)'.
- Application Name:** A section with a 'More information' link and a text input field containing 'Please tell us the name of the application that will be using this database.' Below the input field is a large empty text area.
- Database Information and Usage:** A section with a 'More information' link and a text input field containing 'Please tell what business processes will be enabled by this database and briefly summarize the database's functionality so we can ensure appropriate quality of service.' Below the input field is a large empty text area.
- Database Owner:** A section with a text input field.

Web Form for Ordering EMC's Private Cloud Database Service

Cloud Interfaces

- Enable computing and management of rented service instances
- Types of cloud interface:
 - Management interface: Enables a consumer to control his use of a rented service
 - Functional interface: Enables a consumer to use service functions



Source: NIST SP 500-291

Management Interface

- A self-service interface to monitor, modify, start, and stop rented service instances
- It facilitates consumers to prepare desired functional interface
- Management functions are different for different service models

IaaS Functions	PaaS Functions	SaaS Functions
<ul style="list-style-type: none">• Start, stop, and configure VMs• Allocate private IP addresses to VMs• Add DNS server, load balancer, and public IP address• Add storage volumes of specific size	<ul style="list-style-type: none">• Configure execution/runtime environment for a business application• Add, configure, and delete database• Modify infrastructure resources that are available to applications and database• Add authentication service to secure access to applications	<ul style="list-style-type: none">• Add new users• Change user roles and permissions• Customize application functionality for each user

Functional Interface

- Presents functional content of a service instance to perform computing activities
- Functional content is different for different service models

IaaS Content	PaaS Content	SaaS Content
<ul style="list-style-type: none">• Specifics of hardware, such as processors, memory, network adapters, and storage volumes	<ul style="list-style-type: none">• Integrated development environment (IDE) that consists of programming interface, libraries, and tools• Development environment offered by software development kit (SDK)	<ul style="list-style-type: none">• Graphical user interface (GUI) of a business application

Lesson Summary

During this lesson the following topics were covered:

- Service layer functions
- Service catalog and its elements
- Service ordering
- Management and functional interfaces of cloud services

Lesson: Cloud Portal

This lesson covers the following topics:

- Cloud portal functions
- Personalization of cloud portal

Introduction to the Cloud Portal

Cloud Portal

A cloud portal is a web portal that presents service catalog and cloud interfaces, enabling consumers to order and manage cloud services in an on-demand, self-service way. A cloud portal is also accessed by the cloud administrators to manage cloud infrastructure and the lifecycle of cloud services.

- Cloud portals are hosted on one or more portal servers
- Cloud portals are created using portal software
 - Enable providers to design and publish cloud portals
- A user may use URL of cloud portal to logon to the portal

Cloud Portal Functions

A cloud portal has two key functions:

- Presentation
 - Organization and display of service information and management functions to the users
- Interaction with orchestration layer
 - Sending service requests to orchestration layer and receiving response

Presentation

A cloud portal commonly presents following elements:

- Service catalog
 - Lists and describes service offerings
 - Includes action buttons or links to order a service
- Management interface
 - Presents information about all services ordered by a consumer
 - Includes action buttons or links to manage rented service instances
- Link to functional interface
 - Portal provides link to a provisioned service instance
 - Consumer gets access to functional interface using the link

Layout of Management Interface

- Management interface is designed like a digital dashboard
 - Displays service information in real-time
 - Provides a central point to manage rented service instances
- Management interface is presented across portlets or windows
 - Portlets group management functions and service information

The screenshot displays the EMC VMAX Cloud Edition management interface. The interface is divided into several sections:

- Portlet or Window:** A red box highlights the main content area, which includes the application details and the table of storage volumes.
- Management Interface:** A label pointing to the overall interface.
- Action Button for Management Function:** A label pointing to the 'Return to Application Summary' button.
- Service Information:** A label pointing to the table of storage volumes.

The application details section shows:

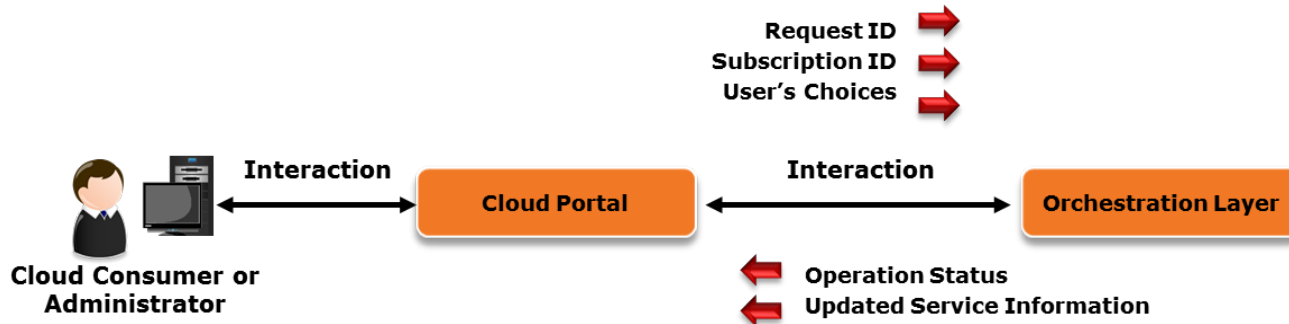
- Application: vCloud
- Number of Volumes: 4
- Storage (GB): 128
- Number of Replicas: 0
- Replica Storage (GB): N/A
- %Used (All Hosts): 0
- Status (All Hosts): Green

The table of storage volumes is as follows:

Name	Host Group	Level	Provisioned	% Used	Status	Action
DS001	vSphere	Bronze1...	32/0	0%	Green	Details Modify
DS002	vSphere	Gold1 DARE	32/0	0%	Green	Details Modify
DS003	vSphere	Platin...	32/0	0%	Green	Details Modify
DS004	vSphere	Diamond...	32/0	0%	Green	Details Modify

Interaction with Orchestration Layer

- Portal routes service requests to orchestration layer
 - Orchestration layer triggers appropriate workflows for process automation
- Portal receives response back from orchestration layer
 - Responses are presented to users



Personalization of Cloud Portal

- Personalization helps displaying information based on user's identity, role, organization, and other access rights
- Personalization ensures that a user has his own view of portal content
 - Meets security and compliance needs to order and manage service
- Portal populates personalized content based on predefined policy

Role	Profiles for Personalization
Cloud Administrator	<ul style="list-style-type: none">• Administrative access to cloud infrastructure, service management functions, and data• Monitor consumer accounts, their order status, consumed resources, and support services
Tenant Administrator	<ul style="list-style-type: none">• Administrative privilege to order, modify, and decommission services• Add tenant user, set access rights and resource quota, and approve user's service requests
Tenant User	<ul style="list-style-type: none">• Access services allocated by tenant administrator• Start, stop, and modify available services

Lesson Summary

During this lesson the following topics were covered:

- Presentation
- Interaction with orchestration layer
- Personalization of cloud portal

Lesson: Interface Standards and Protocols

This lesson covers the following topics:

- Cloud interface standards for portability
- Cloud interface standards for interoperability
- Common protocols for service access

Standardization Overview

Cloud Interface Standardization

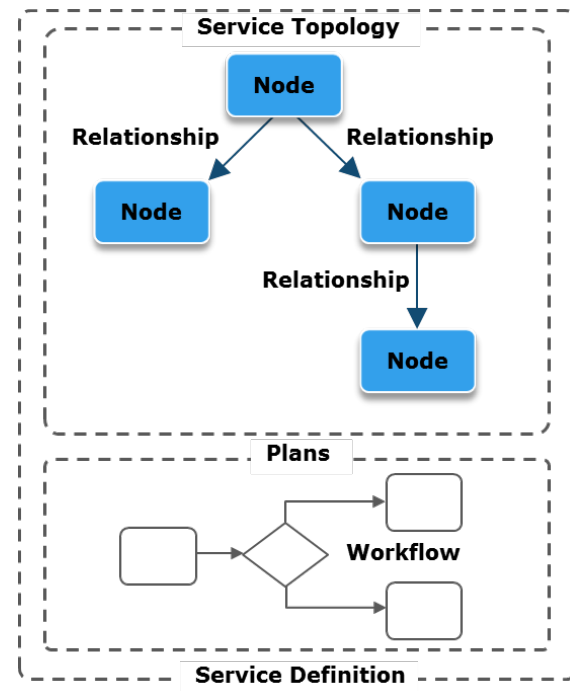
A process to formulate a norm or a specification for common and repeated use in regard to development and implementation of cloud interfaces for achieving uniformity across service providers.

- **Benefits:**
 - Establishes conformity to specific feature set or quality level
 - Enhances portability and interoperability across clouds

Interface Standards for Portability – TOSCA

Topology and Orchestration Specification for Cloud Applications (TOSCA)

- Standardizes language to define a service independent of provider or hosting technology
- Topology and plans can be interpreted by TOSCA compliant cloud
 - Facilitates portable deployment of services to any compliant cloud



Interface Standards for Portability – OVF

Open Virtualization Format (OVF)

- Open standard for packaging and distribution of virtual appliances
 - Enables packaging services as virtual appliances and facilitates portability across different cloud platforms
- OVF package includes metadata about VMs such as
 - Number of processors, memory space, and network configuration
- Metadata is used by a cloud platform to deploy a service

Interface Standards for Interoperability

Open Cloud Computing Interface (OCCI)

Specification for IaaS management interface

Cloud Infrastructure Management Interface (CIMI)

Specification for IaaS management interface

Cloud Data Management Interface (CDMI)

Standard for both management interface and functional interface of a storage service

Cloud Application Management for Platforms (CAMP)

Standard for PaaS management interface

Common Protocols for Service Access

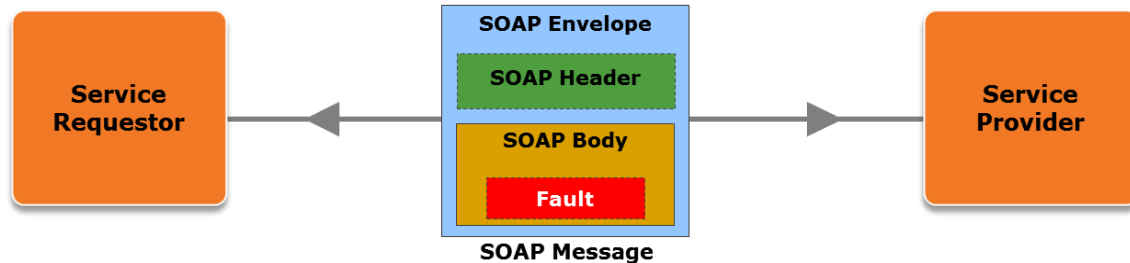
- Cloud services are usually accessed using web services
 - Enable client applications to communicate with web servers that present cloud interfaces
 - Uses standard web protocols, commonly HTTP
 - Applications running on a variety of platforms can communicate
- Web services are primarily based on:
 - Simple Object Access Protocol (SOAP)
 - Representational State Transfer (REST)

Simple Object Access Protocol (SOAP)

- Protocol for exchanging structured information (message) between applications
 - Application can be a service requestor or a service provider
- Uses XML for formatting messages that are commonly transferred using HTTP
 - SOAP request in a HTTP request and SOAP response in a HTTP response
- Specifies the binding of HTTP header and XML file

Elements of SOAP Message

- Envelope element (required): Root element of a SOAP message
- Header element (optional): Contains information such as authentication and account number
- Body element (required): Contains request or response
- Fault element (optional): Contains error codes and error messages



Representational State Transfer (REST)

- Client-server software architectural style
 - Used for developing web services
 - Commonly leverages HTTP for client-server interaction
- RESTful web services follow the design principles as listed below:
 - Resource identification using URI
 - Use of standard HTTP methods
 - Resource manipulation using resource representation
 - Stateless interaction

Resource Identification Using URI

- All objects exposed by web services are treated as resources and are uniquely identified by their URIs
- URIs typically have a directory-like structure
 - Enable access to resources to the finest levels of granularity
- Example of URI:

`http://www.serviceprovider.org/{subscription-id}/services/{service-name}`

Parameters for Search Criteria used by a Web Server

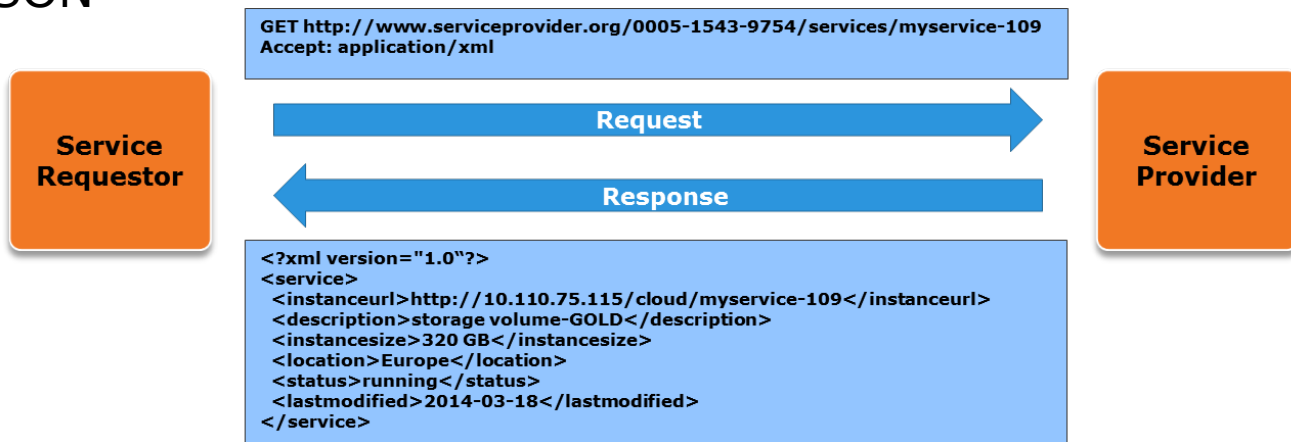
Use of Standard HTTP Methods

- Limited number of HTTP methods are used to manipulate resources
 - PUT: Creates a new resource
 - GET: Retrieves current state of a resource
 - POST: Transfers a new state onto a resource
 - DELETE: Deletes a resource
- Example of HTTP operation:

```
GET http://www.serviceprovider.org/0005-1543-9754/services/myservice-109
```

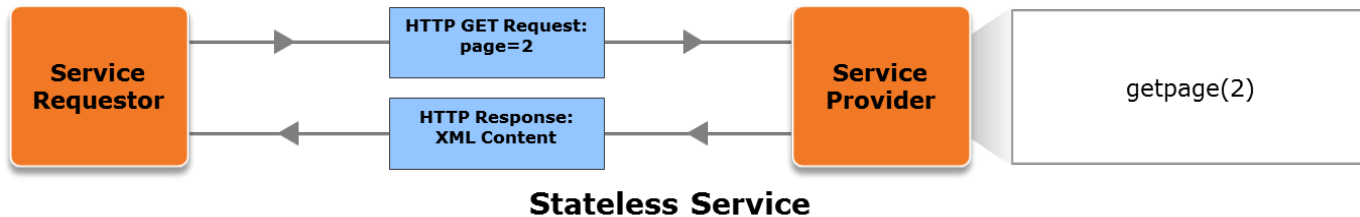
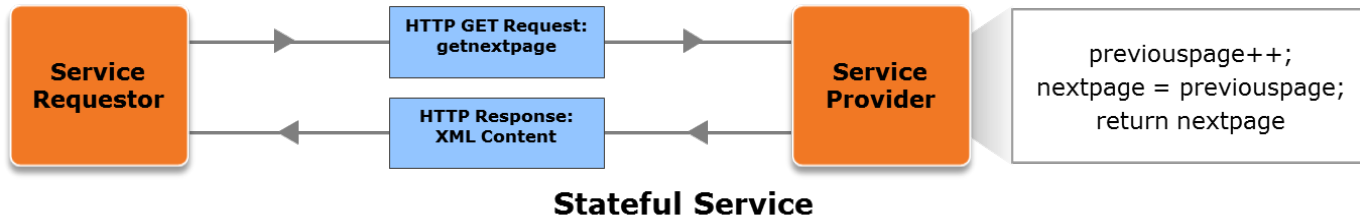
Resource Manipulation using Resource Representation

- Resource representation: current state of a resource at the time when an application requests it
 - Performs actions on resource by using resource representation
- Resources are decoupled from their representation
 - Helps accessing resource content in HTML, XML, plain text, and JSON



Stateless Interaction

- Service requestor includes all the data that are needed by a service provider to generate a response within HTTP request
 - Service provider need not store application state
 - Improves web service performance



Lesson Summary

During this lesson the following topics were covered:

- Interface standards for portability – TOSCA and OVF
- Interface standards for interoperability – OCCI, CIMI, CDMI, and CAMP
- SOAP and REST

Lesson: Service Orchestration

This lesson covers the following topics:

- Orchestration software
- System integration using orchestration software
- Application programming interface
- Orchestration use cases

Introduction to Service Orchestration

Service Orchestration

Automated arrangement, coordination, and management of various system or component functions in a cloud infrastructure to provide and manage cloud services.

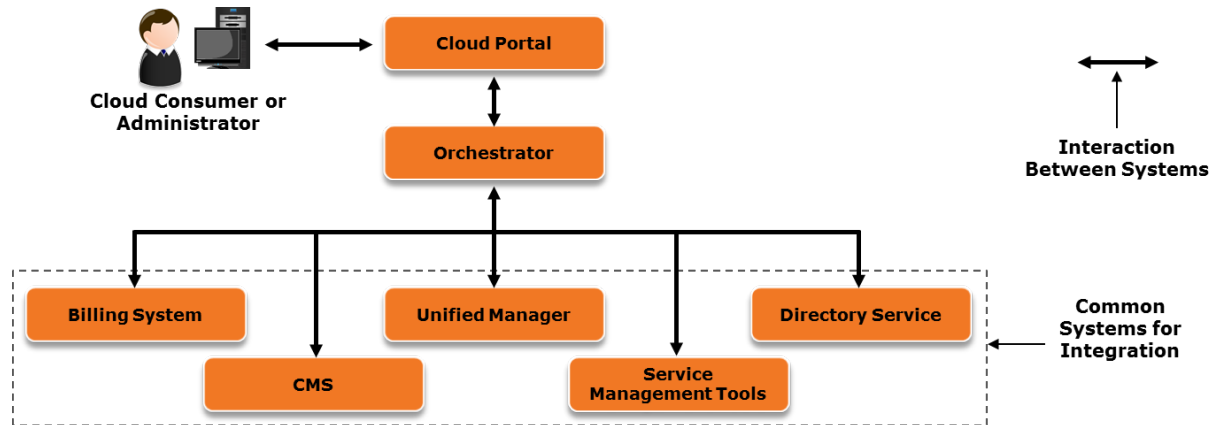
- Benefits:
 - Saves service provisioning time
 - Eliminates possibility of manual errors
 - Reduces operating expenses
 - Simplifies cloud infrastructure management

Orchestration Software or Orchestrator

- Programmatically integrates and sequences various system functions into automated workflows
 - For executing service provisioning and management functions provided by the cloud portal
- Provides a library of predefined workflows and an interface to create user-defined workflows
 - Triggers an appropriate workflow upon receiving a request from the cloud portal

System Integration using Orchestrator

- Connection of multiple system or component functions into a workflow to provide and manage services
- Orchestrator enables defining workflows to logically integrate system functions
 - Interacts with appropriate systems based on pre-defined workflows

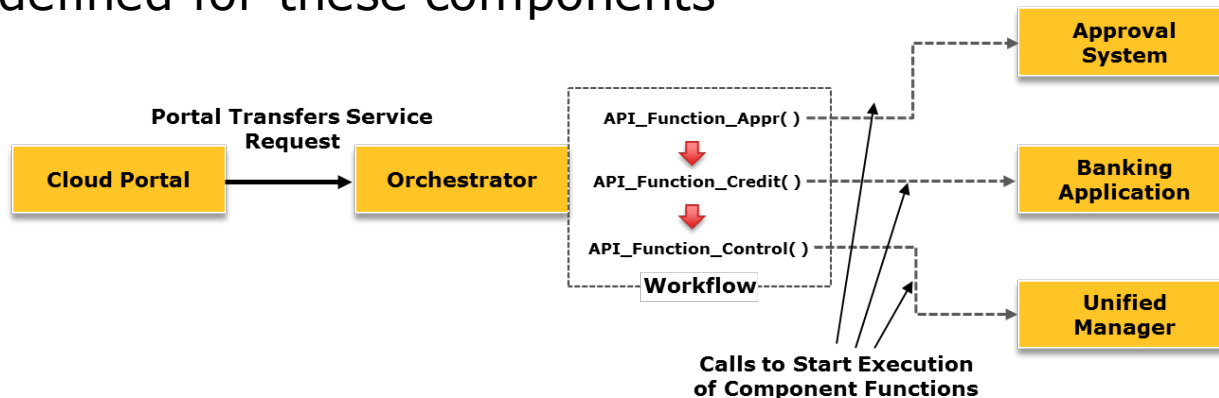


Application Programming Interface (API)

Application Programming Interface

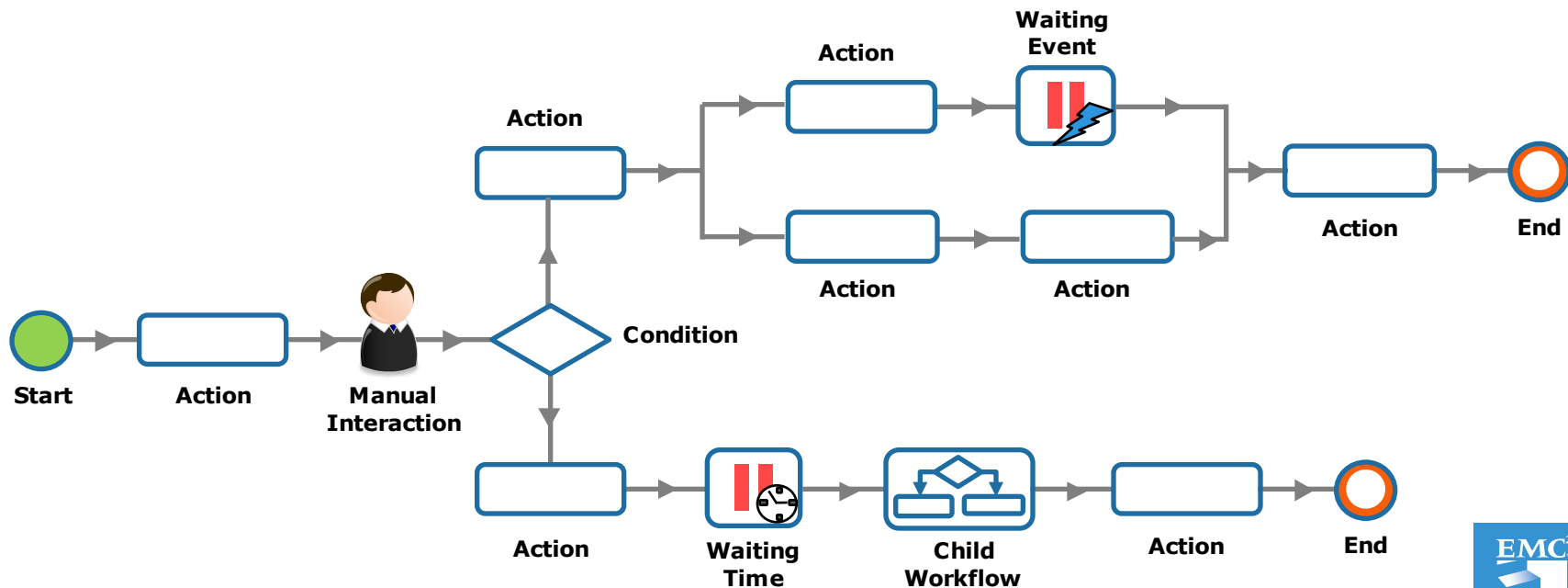
A source-code-based specification intended to be used by software components as an interface to communicate with each other. It specifies a set of component functions that can be called from a software component to interact with other software components.

- Orchestrator commonly interacts with other components using APIs that are defined for these components



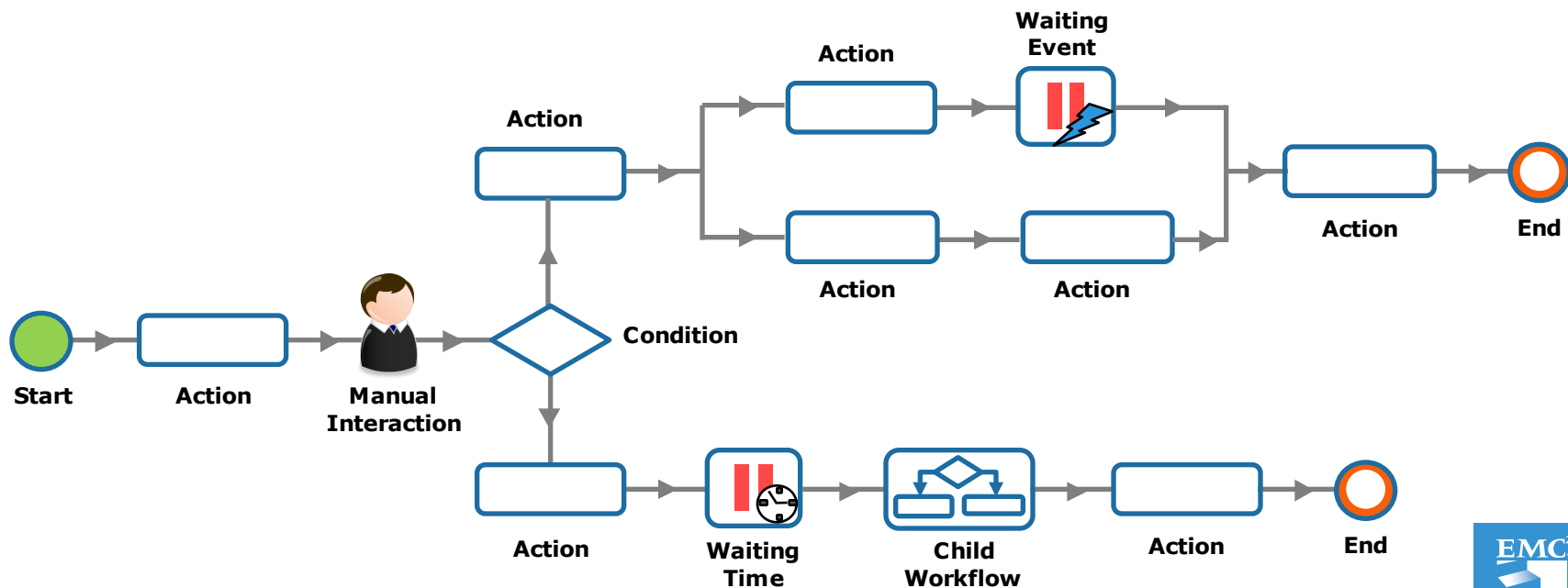
Workflow Modeling

- Orchestrators commonly provide interfaces to model workflows
- Common elements in a workflow are:

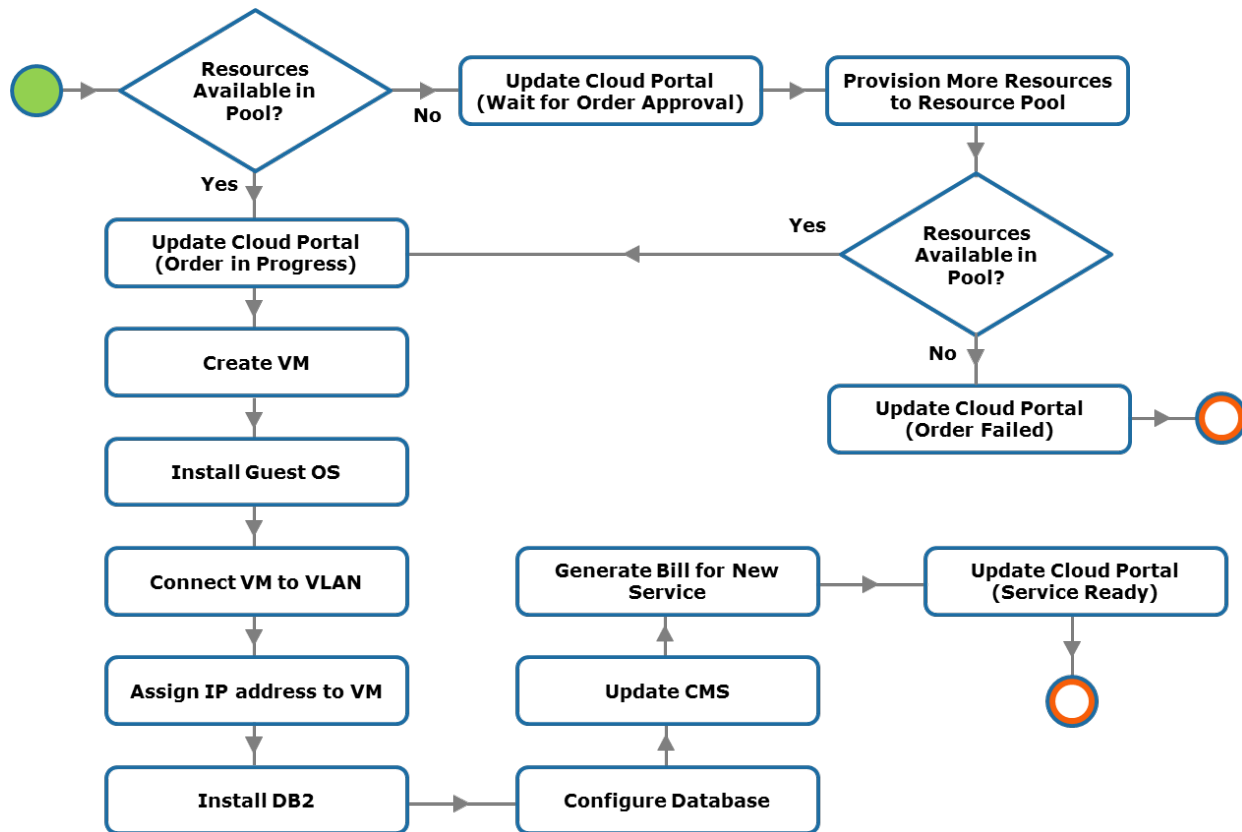


Workflow Modeling

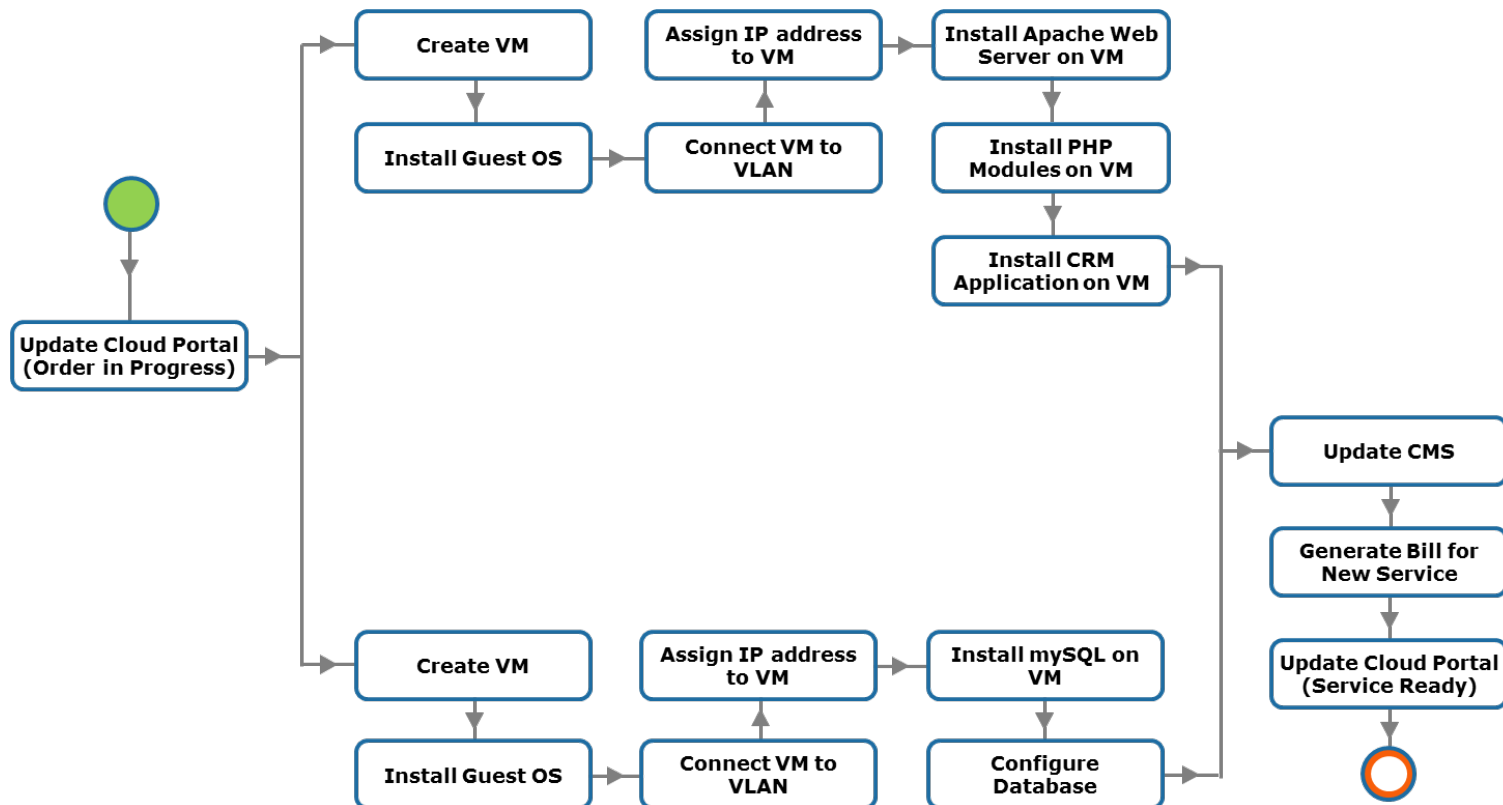
- Orchestrators commonly provide interfaces to model workflows
- Common elements in a workflow are:



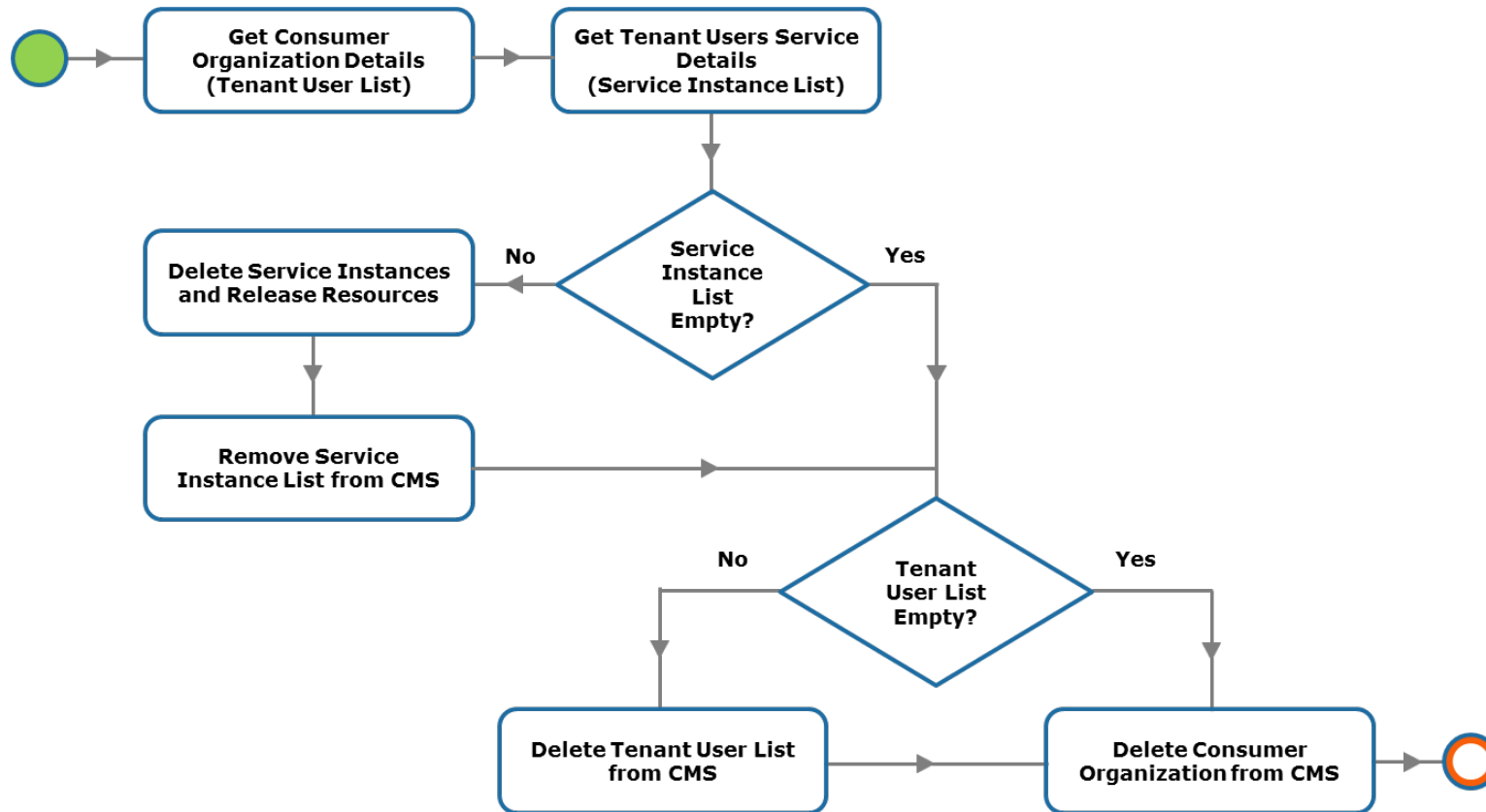
Orchestration Use Case: Provisioning DB2 Database



Orchestration Use Case: Provisioning CRM Application



Orchestration Use Case: Removing Tenant



Lesson Summary

During this lesson the following topics were covered:

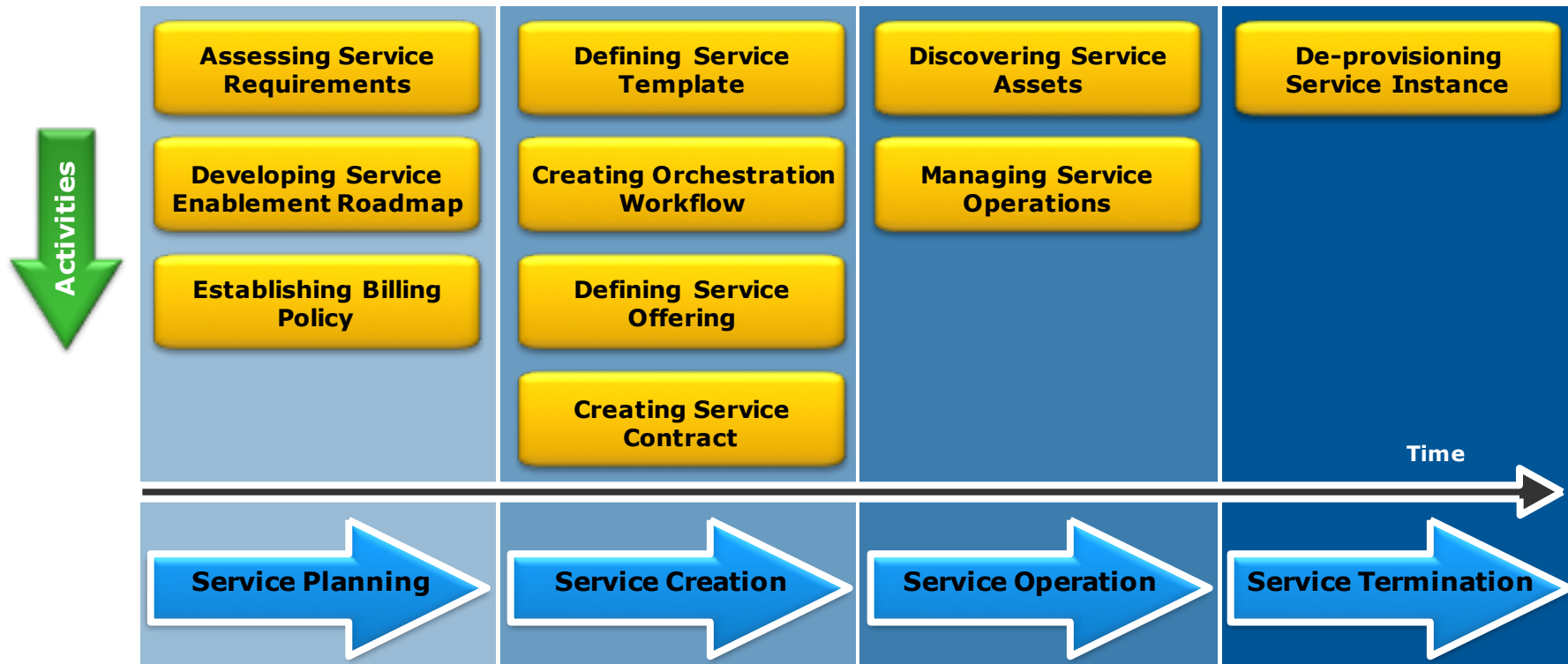
- Orchestration software
- Integration of system functions by orchestrator
- Orchestrator APIs
- Orchestration use cases

Lesson: Cloud Service Lifecycle – I

This lesson covers the following topics:

- Cloud service lifecycle overview
- Service planning phase of cloud service lifecycle

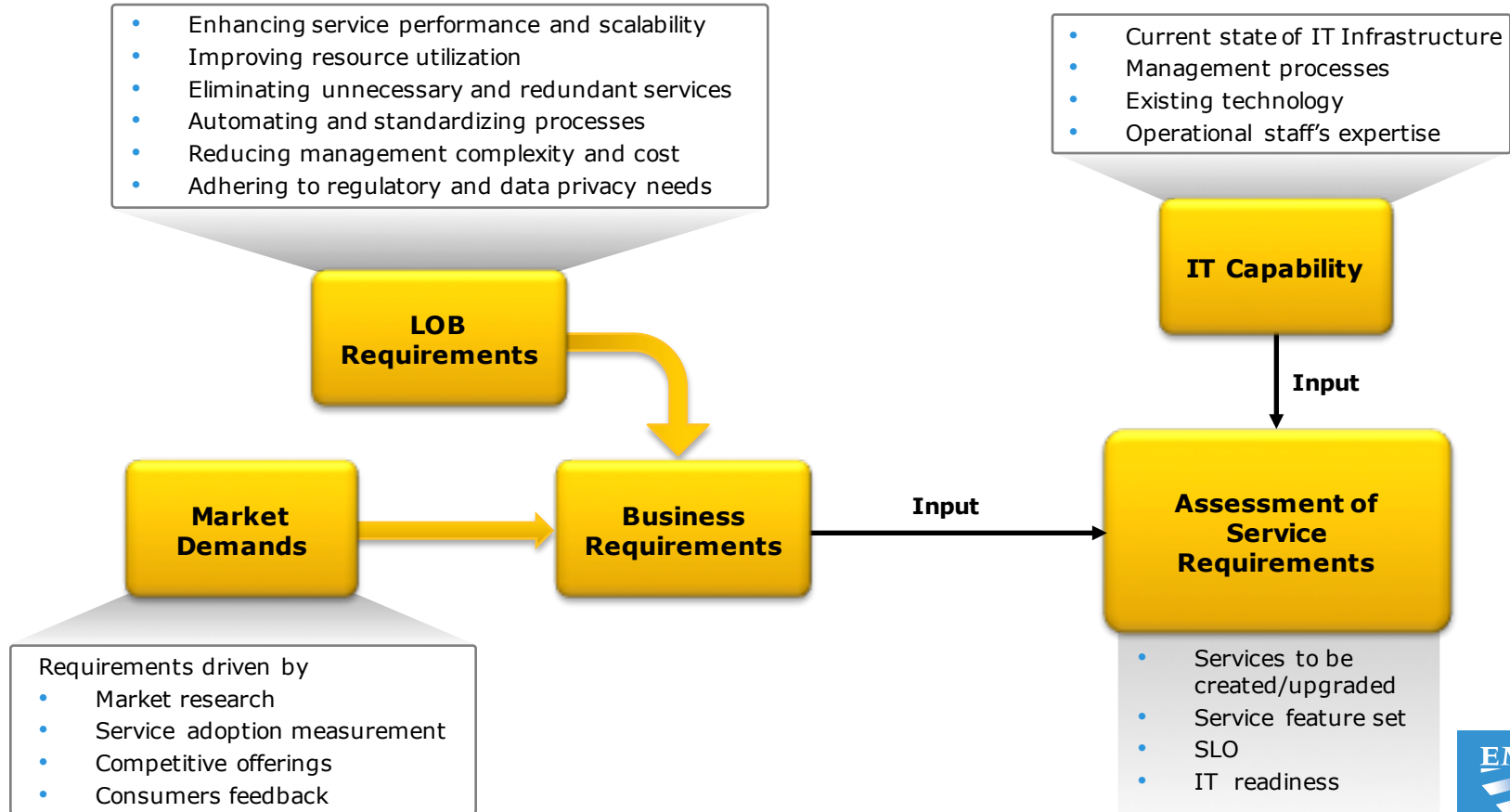
Cloud Service Lifecycle



Phase 1: Service Planning

- It involves making business case decisions for cloud service offering portfolio
- Common activities during service planning are:
 - Assessing service requirements
 - Developing service enablement roadmap
 - Establishing billing policy

Assessing Service Requirements



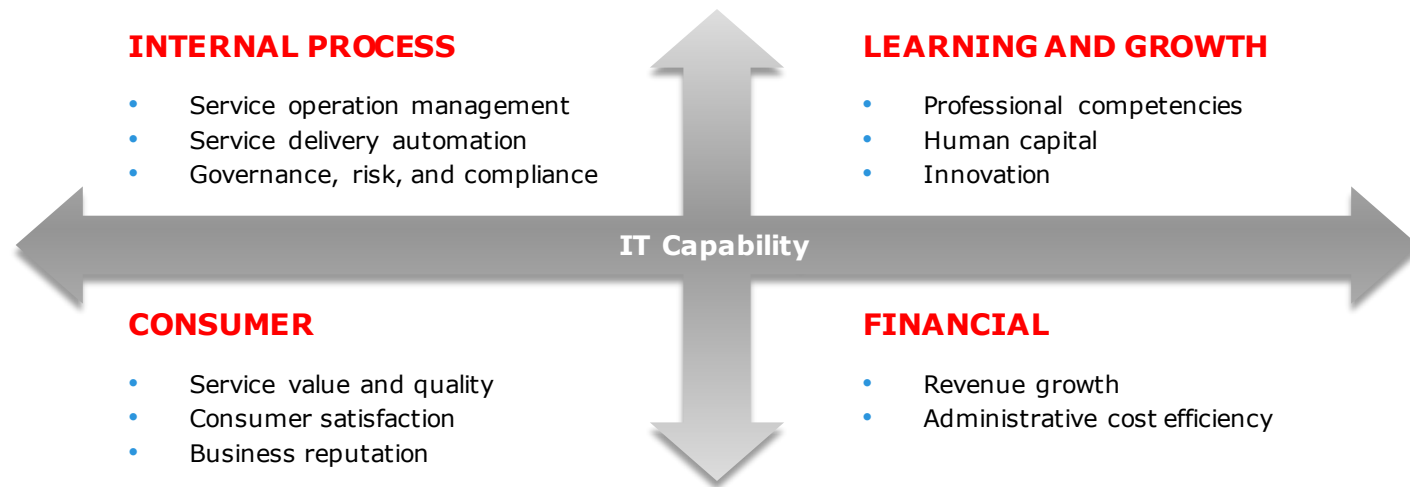
Service Requirement Assessment Questions

- What services will be created or upgraded?
- What is the appropriate service model - SaaS, PaaS, or IaaS?
- What software and hardware resources are required to provide the services?
- What architecture, process, staffing, skill set, budget, and technologies are required to provide the services?
- What levels of performance, availability, and security will be provided for the services?
- Who are target consumers? Why would consumers desire these services? What is the projected demand level?
- What is the appropriate deployment model (private, public, community, hybrid)?

Service Requirement Assessment Questions (Cont'd)

- If a private or community cloud is chosen, will it be hosted on-premise or externally? If an externally-hosted deployment model is preferred, is there an existing service provider to partner with or will a new one be required?
- What are the regulatory compliance considerations, if any?
- Due to regulations or special circumstances, does the service require that a part of the cloud infrastructure be hosted on-premise and another part with an external service provider?
- What value-added services can be included to a core service based on corporate policy or data classification, for example, backup, disaster recovery, deduplication, and encryption?

IT Readiness Assessment: Balanced Scorecard

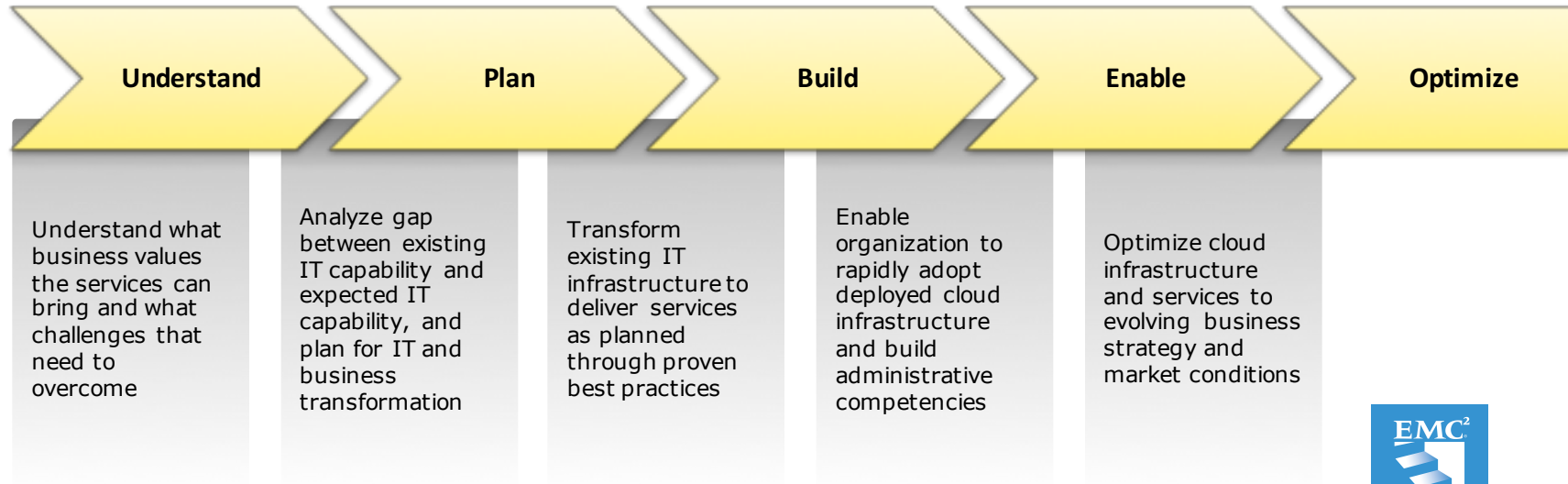


Balanced Scorecard

Perspective	Metric	Strategic Goal	Performance Measure
Internal process	Adherence to policies	100% cases	91% cases
Learning and growth	Problem management skill	80% of staff	60% of staff
Financial	Return on investment	235%	205%
Consumer	Service delivery per provision timeline	95% cases	89% cases

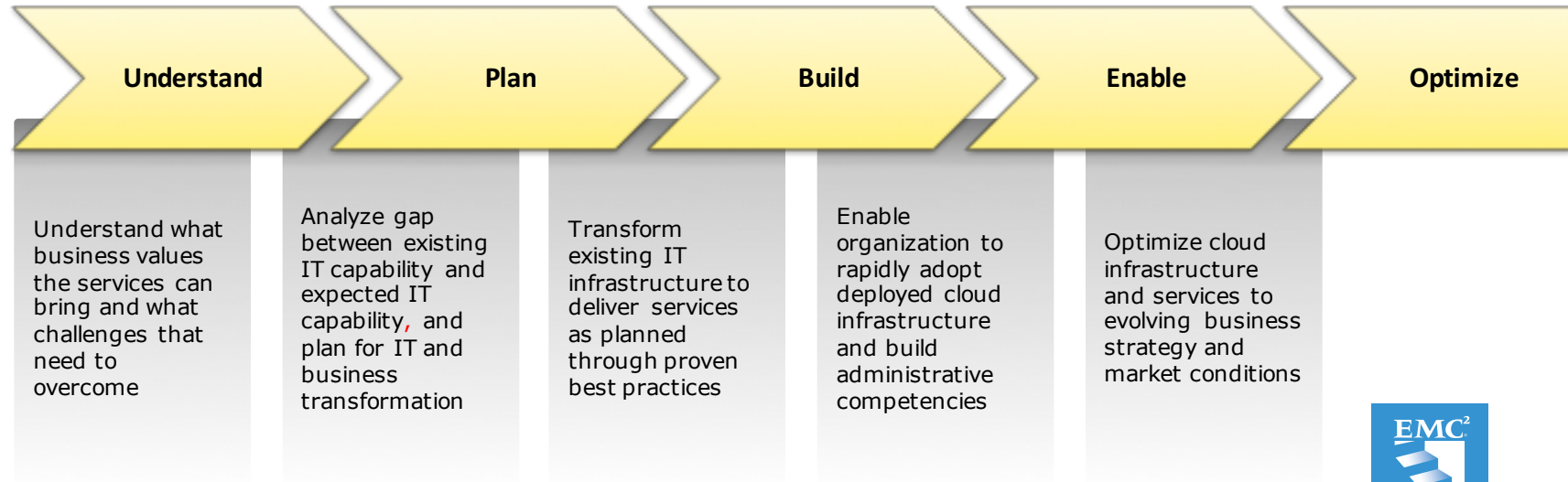
Developing Service Enablement Roadmap

- Service enablement roadmap guides the strategic direction to fulfill service requirements in the provider's organization
 - Provides framework for needed IT transformation, necessary cloud solutions, eliminating skill gaps, and implementation timeline



Developing Service Enablement Roadmap

- Service enablement roadmap guides the strategic direction to fulfill service requirements in the provider's organization
 - Provides framework for needed IT transformation, necessary cloud solutions, eliminating skill gaps, and implementation timeline



Establishing Billing Policy

Billing

A process of generating bills from the resource usage data for cloud services using predefined billing policies.

- Billing system collects usage data for cloud services from control layer to generate bill for each consumer
 - Measures number of units of service usage per consumer
 - Enables metering for cloud services
- In private cloud, chargeback and showback are commonly used
 - Chargeback: Ability to measure resource consumption per business unit and charge them back accordingly
 - Showback: Reporting of service charges against resource usage without applying charges to business units

Considerations for Billing Policy

- Provider's business goals
 - Making a profit
 - Justifying new capital spending
 - Influencing consumption behaviors by business units
 - Making IT more service aware, cost conscious, and accountable
 - Comparing IT costs with the charges of the public service provider
- Service-specific pricing strategy
 - Identifying costs related to a cloud service
 - Planning for recovery of cost recovery, profit, meeting ROI and reinvestment goals, and adjustments driven by competitive services
 - Determining chargeable unit of demand per service
 - Determining price per chargeable unit

Lesson Summary

During this lesson the following topics were covered:

- Cloud service lifecycle overview
- Assessing service requirements
- Developing service enablement roadmap
- Establishing billing policy

Lesson: Cloud Service Lifecycle – II

This lesson covers the following topic:

- Service creation phase of cloud service lifecycle

Phase 2: Service Creation

- It involves defining services in the service catalog and creating workflows for the service orchestration
- Common activities during service creation are:
 - Defining service template
 - Creating orchestration workflow
 - Defining service offering
 - Creating service contract

Defining Service Template

Service Template

A collection of interrelated hardware and/or software components that constitute a service and work together upon deployment of a service.

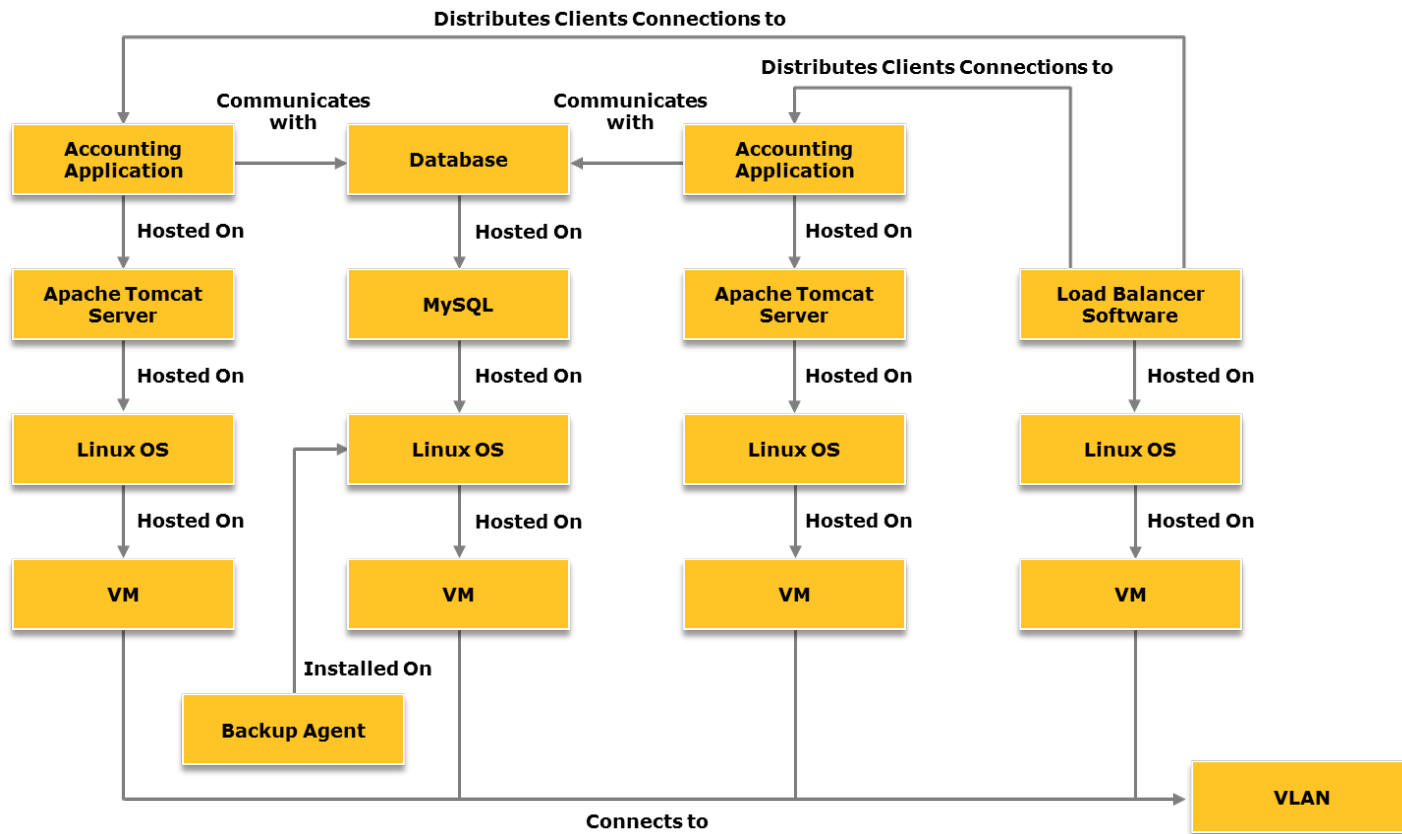
- Resources are allocated, configured, and integrated as per service template to create an instance of a service
 - Template provides standard to create predictable service instances
- Service templates are defined in service catalog
 - Facilitates consumers to understand service capabilities
 - Provides guidelines to create workflows for service orchestration
- Service template specifics may include fixed and/or customizable options

Defining Service Template (Cont'd)

Service template specifics commonly covers the following entities:

- Service structure
 - Specifies the structure of a service that includes service components and their relationships
- Service attribute
 - Specifies default configurations of service components
- Service operation
 - Specifies management operations that can be performed on management interface of a service

Example of Service Structure



Creating Orchestration Workflow

- Workflows for service orchestration are created in orchestrator based on service template specification
- Workflows enable automated allocation, configuration, and integration of resources for a service as per service template
 - According to the workflows, orchestrator interacts with infrastructure components

Defining Service Offering

Service Offering

An entry in the service catalog that describes a service template combined with constraints, policies, rules, price, and SLA.

- **Constraint:** Restricting access to a service to certain individuals or groups
- **Policy:** Setting bandwidth quota, firewall configuration, and QoS on a per-service or per-consumer basis
- **Rule:** Guidelines for service deployment and scaling, limiting resource allocation, and subscription period

Defining Service Offering (Cont'd)

- Price: Service charge, initial data transfer charge, fees for support and recovery of data
- SLA: Service level targets and responsibilities

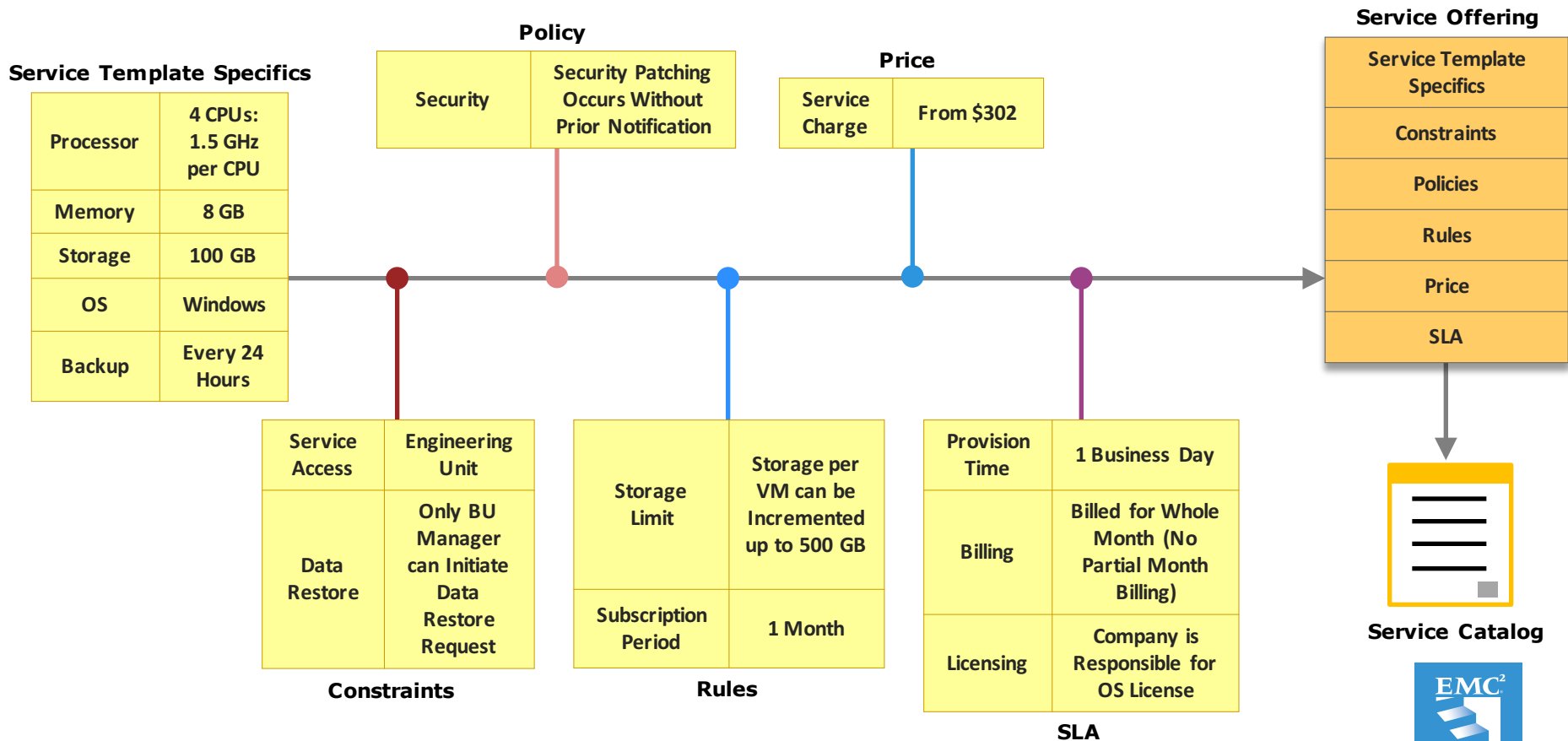
SLA – Key Questions

- What are the minimally acceptable performance and availability levels?
- Is there a limit on the amount of resources that can be consumed?
- How is a service outage defined? How are consumers compensated for an outage? What alternative methods of access are offered if there is an outage?
- What is the level of service performance during maintenance periods?
- Do consumers need to pay any licensing fees above and beyond the service charges?
- Where will the primary copy of consumer's data be stored? How will it be protected?

SLA – Key Questions (Cont'd)

- Are compliance adherence and data security offered as supplementary services?
- Will consumers be notified if a law enforcement agency requests their data?
- What kinds of customer service and response time guarantees are to be provided?
- What types of cloud service auditing methods will be used to assess service operations, security controls, data privacy impact, and service performance? Is the auditing conducted internally by the service provider, by an independent auditing authority, or is it consumer initiated?

Example of Service Offering



Creating Service Contract

Service Contract

An agreement between the service provider and the service consumer stating the terms of service usage. The two parties enter into a contract describing agreements on pricing, SLAs, termination of service, and any specific configuration options.

- Service contract specifics is commonly presented on portal
 - Describes terms and conditions for using a service
- Service contract must be established with the provider while ordering a service
 - A contract is established by agreeing to the terms and conditions

Lesson Summary

During this lesson the following topics were covered:

- Defining service template
- Creating orchestration workflow
- Defining service offering
- Creating service contract

Lesson: Cloud Service Lifecycle – III

This lesson covers the following topics:

- Service operation phase of cloud service lifecycle
- Service termination phase of cloud service lifecycle

Phase 3: Service Operation

- It involves ongoing management operations to maintain cloud infrastructure and deployed services
- Common activities during service operation are:
 - Discovering service assets
 - Managing service operations

Discovering Service Assets

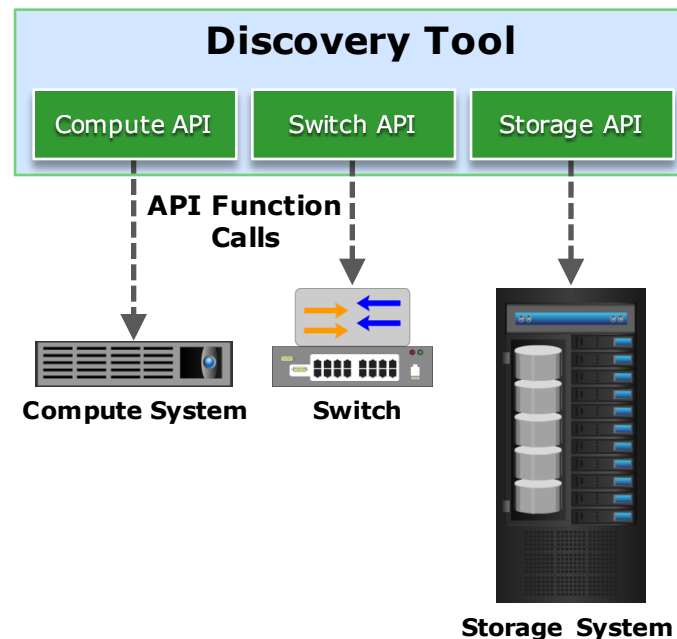
Discovery

An activity that creates an inventory of service assets and provides information about the assets including their configuration, connectivity, functions, performance, capacity, availability, utilization, and physical-to-virtual dependencies.

- Discovery provides visibility into each service asset
- Discovery enables monitoring cloud infrastructure resources centrally

Discovering Service Assets (Cont'd)

- Discovery is performed using specialized tool
- Discovery tool commonly interacts with service assets through APIs
 - Collects necessary data from service assets
- Discovery is typically scheduled to occur periodically
 - May also be initiated by cloud administrator or orchestrator



Discovery – Key Questions

- What are the service assets?
- What information needs to be collected for each service? What are the measurement metrics?
- How frequently the information should be collected?
- When the discovery activity should be performed? Will it impact service performance?
- Which tools are needed to perform the discovery?

Managing Service Operations

- Involve service-related operations across cloud infrastructure
- Ensure and restore service levels while continuously optimizing management operations
- Key management operations include:
 - Monitoring and reporting
 - Provisioning
 - Troubleshooting
- Key goal is to automate service operations as much as possible

Managing Service Operations

- Involve service-related operations across cloud infrastructure
- Ensure and restore service levels while continuously optimizing management operations
- Key management operations include:
 - Monitoring and reporting
 - Provisioning
 - Troubleshooting
- Key goal is to automate service operations as much as possible

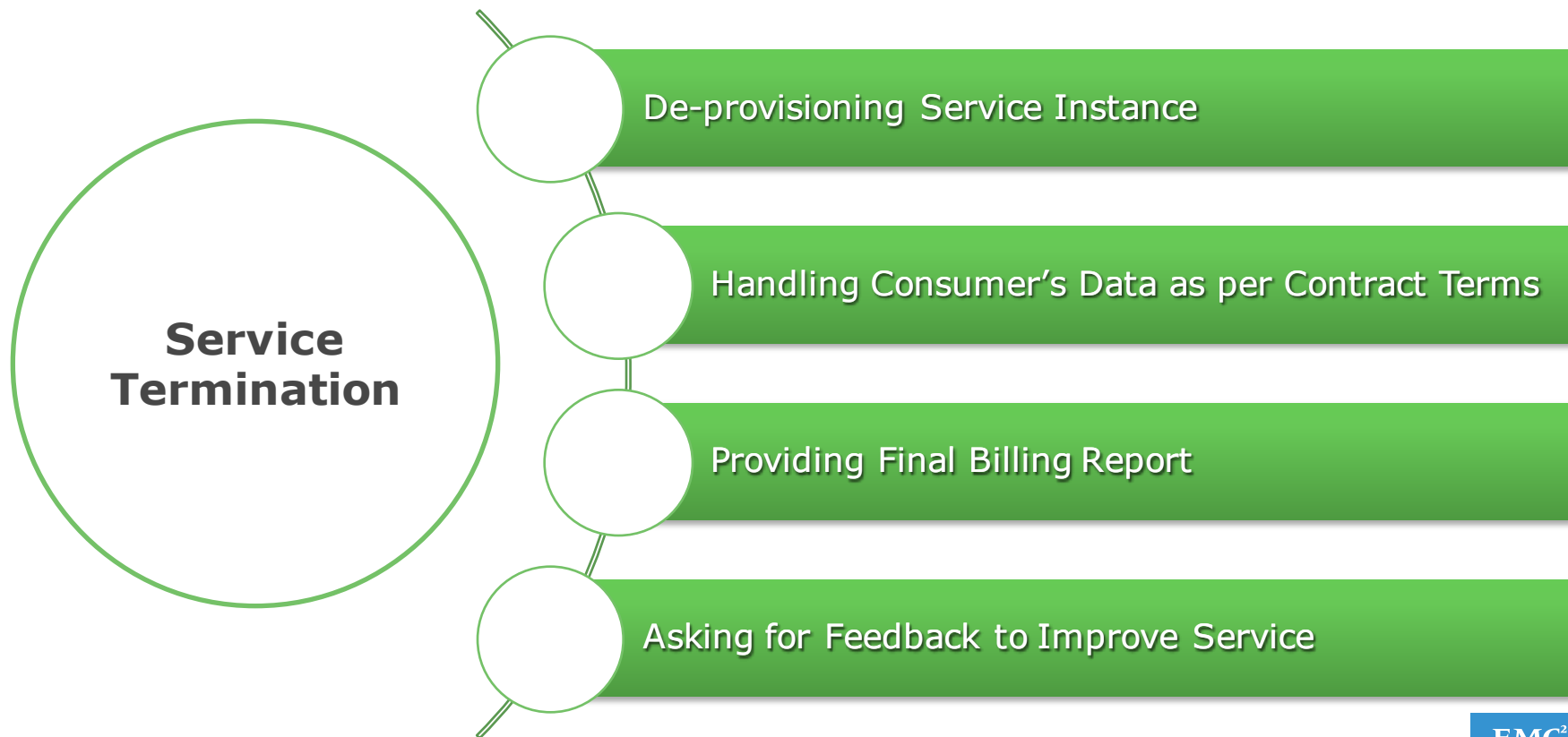
Phase 4: Service Termination

- Removes previously assigned service instances and releases resources to resource pool for redeployment to other instances
- Must not impact other service instances and consumers' data, resources, and confidential information
- A cloud service may be terminated in the following scenarios:
 - Natural termination by contract agreement
 - Initiated termination by a provider or a consumer

Reasons for Initiated Service Termination

- Common reasons for provider to terminate service:
 - Business circumstances where provider can no longer offer a service
 - A disaster
 - Significant consumer violation of contract terms
 - New hardware deployment or software upgrade
- Common reasons for consumer to terminate service:
 - Business circumstances where consumer no longer needs service
 - Service requirement was planned to be temporary
 - Service performance or support is not acceptable

Common Activities in Service Termination



Lesson Summary

During this lesson the following topics were covered:

- Service operation – discovering service assets and managing service operations
- Service termination – de-provisioning of service instance

Concepts in Practice

- VMware vCenter Orchestrator

VMware vCenter Orchestrator

vCenter Orchestrator

- An orchestration software to automate provisioning and operational functions in a cloud infrastructure
- Enables cloud administrators to:
 - Use pre-defined workflows from built-in library
 - Create customized workflows by linking actions together
- Can execute hundreds or thousands of workflows concurrently
- Can be installed as a virtual appliance or on a Windows server

Module Summary

Key points covered in this module:

- Service catalog and service ordering
- Management and functional interfaces of services
- Cloud portal and its functions
- Cloud interface standards
- SOAP and REST
- Service orchestration and cloud service lifecycle